

piceous; antennæ 15-jointed, joints twelfth and thirteenth white, five or six of the basal joints rufo-piceous, as are also the palpi; the prothorax oblong-quadrate, narrowly margined, and with a longitudinal impressed line not extending to the posterior margin; not winged; the abdomen smooth and shining; the basal half of the segments with fine shallow punctures; the apical segment with a deeply impressed longitudinal line, its posterior margin emarginate; the forceps very stout, triangular at the base, curved inwardly beyond the middle, acute at the apex, their inner margin crenulated.

(Coll. by Gulliver.)

This species has a close general resemblance to *F. maritima*.

LIII.—*Contributions to the Study of the chief Generic Types of the Palæozoic Corals.* By JAMES THOMSON, F.G.S., and H. ALLEYNE NICHOLSON, M.D., D.Sc., F.R.S.E., Professor of Natural History in the University of St. Andrews.

[Continued from p. 305.]

[Plates XXI.—XXV.]

Genus CLISIOPHYLLUM.

Clisiophyllum, Dana (in parte), Explor. Exped. vol. viii. Zoophytes, p. 361, pl. xxvi. fig. 6 (cæt. exclus.), 1846.

Gen. char. Corallum simple, cono-cylindrical, or turbate. Epitheca complete, sometimes thin, sometimes thick, marked with constrictions and accretion-ridges. Calice of variable depth, its floor exhibiting a conical boss in the centre. The surface of the boss is marked with a system of spirally bent or sometimes straight lamellæ, which are attached to the inner margins of the primary septa by the intervention of a system of delicate dissepiments, and, on the other hand, pass upwards to a median columellar crest on the crown of the boss. Septa well developed, of two orders, the primary septa never extending further inwards than near to the outer margins of the central boss. Internal structure triareal. Central area ("interlamellar space") formed partly by a system of vertical, spirally twisted or straight lamellæ, and partly by a system of vesicular tabulæ, which intersect the former obliquely, and are directed upwards and inwards to join in the columellar line. Intermediate area ("interocular space") formed by an outward extension of the tabulæ in large nearly horizontal vesicles. External area ("interseptal space") formed

by minute vesicular tissue, the vesicles of which are arranged in oblique rows directed outwards and upwards.

The corallum in *Clisiophyllum* is invariably simple; and only those examples in which the calice is well preserved afford any external indication of its singularly complex interior constitution. The form of the corallum is usually more or less conical, generally curved, and rarely attaining a large size. The epitheca is variable in thickness, and is usually marked by numerous encircling striæ and annulations of growth.

The calice is circular, sometimes deep and sometimes shallow, its margins thin, or at other times thick and everted. From the centre of the floor of the calice rises a prominent conical boss or tent-shaped mass, the summit of which shows a longitudinal crest, while its surface is marked, in well preserved examples, by spirally twisting or straight ridges which pass from its base to its crown (Pl. XXII. fig. 1). This tent-shaped boss has been regarded as the upper extremity of a gigantic columella or pseudo-columella; but its true constitution is rendered apparent by means of transverse and longitudinal sections. When examined in longitudinal section, the centre of the boss is seen to be formed by a columellarian lamina, which extends as a continuous line (Pl. XXI. figs. 2 A & 4) from the bottom of the visceral chamber to the summit of the calicine dome, where it appears as the median crest above spoken of. This median crest has been stated to become directly continuous with one of the primary septa; but we have been unable to confirm this observation; and, in point of fact, sections indicate clearly that the columellar line is confined to the centre of the visceral chamber. The outer portions of the boss and its downward continuation are minutely vesicular, and are formed by the intersection and combination of two different sets of plates. One of these can only be seen in cross sections (Pl. XXI. figs. 1-3), and consists of a series of vertical, more or less spirally twisted lamellæ, which have usually been regarded as the inward prolongations of the primary septa. They are, however, in reality, wholly independent of the septa, with which they are never connected, except it be by means of a few flexuous and delicate dissepiments, to which they are always much inferior in number. It is the plates of this series, also, which form the radiating ridges on the surface of the conical boss within the calice. The plates of the *second* series are seen in transverse sections (Pl. XXI. figs. 1-3) as a series of delicate, somewhat curved laminae, which run across and closely intersect the spaces between the lamellæ of the *first* or vertical series; but they are most characteristically displayed in longitudinal sections. When viewed in this

way (Pl. XXI. figs. 2 A & 4), they are seen to form a series of very delicate inosculating tabulæ, which are directed in an *ascending* manner from the exterior of the central area towards the columellar line, with which they finally become connected. By their intersection and conjunction they give rise to a series of minute lenticular vesicles, which are arranged in oblique rows which have a direction *inwards and upwards*. It is to the central elevation and ascent of these vesicular tabulæ that the prominence of the conical boss in the floor of the calice is due. We may add that we have used the word "tabulæ" in this connexion advisedly, since we feel satisfied that the ascending vesicles of this central area are really formed by a modification of structures homologous with the tabulæ of other forms.

Immediately external to the central vesicular area is found a narrow zone ("interocular space"), into which, as shown by cross sections (Pl. XXI. figs. 1-3), the inner extremities of the primary septa are continued. When viewed in longitudinal sections (Pl. XXI. figs. 2 A & 4), this intermediate area is found to be formed by an outward prolongation of the tabulæ, which are now nearly horizontal, and are so connected as to give rise to a series of vesicles of conspicuously larger size than those of the central and external areas.

The septa are numerous, and the primaries extend from the inner surface of the wall to near the margins of the central area, where they cease to exist, a few of them sometimes becoming connected here by means of intermediate dissepiments with the vertical and twisted lamellæ of the centre. The secondary septa alternate with the preceding, and vary much in length, being sometimes short, and at other times fully half as long as those of the first cycle. In the outer two thirds of their extent the septa are united by very numerous delicate rectangular or angular dissepiments, which exist in much diminished numbers between the inner ends of the septa. There is thus formed a dense external zone of vesicular tissue, which is seen in longitudinal sections (Pl. XXI. figs. 2 A & 4) to be formed of lenticular cells arranged in oblique rows having a direction *outwards and upwards*, and thus opposite to the inclination of the vesicles of the central area. Within this external zone, also, the septa become extremely delicate, assuming the form of well-developed laminae as they pass inwards.

The genus *Clisiophyllum* was originally proposed by Prof. Dana (*loc. cit. supra*), and was defined as follows:—"Cyathophyllidæ simplicissimæ, ramosæ, aut aggregato-glomeratæ. Corallum cellis radiatis, medio interno septis sursum conver-

gentibus; axe nullo; lateribus omnino cellulosis." From his short description it appears that Dana included under this name both simple and compound corals, having a central area composed of septa and cells converging upwards (but without a distinct columella), an external vesicular area, and a calice with a conical prominence at the bottom, about which the lamellæ sometimes appear twisted. One of the three figures given by Dana as illustrative of the genus is undoubtedly a true *Clisiophyllum* as at present defined; and it may with great probability be surmised to be the form now known as *C. convseptum*, Keys., which, in this case, must be regarded as the type of the genus. The other two figures represent a compound coral, apparently a species of *Lonsdaleia*.

Milne-Edwards and Haime defined the genus *Clisiophyllum* (Brit. Foss. Cor., Introd. p. lxx, 1850) as follows:—"Corallum simple, turbinate. Septa well developed, and rising towards the centre of the calice so as to form a spurious columella, but not twisted." Subsequently (Pol. Foss. des Terr. Pal. p. 409) they enlarged their previous definition somewhat, whilst preserving its essential features, and, in particular, retaining the erroneous view that the subconvolute laminae of the central area are the primary septa. The species which they select as the type of the genus (viz. *C. Danaanum*) is stated to possess a large and deep fossula—a very unusual feature in the genus.

At the same time Prof. M'Coy (Brit. Pal. Foss. p. 33, 1851) defined the genus *Clisiophyllum* as follows:—"Corallum simple, branched, or aggregate, with vertical radiating lamellæ; a thin epitheca or outer wall; *internal structure*:—(vertical section) central area composed of small vesicular plates and cells converging or arching upwards towards the centre, so as to form a conical boss in the cup; no distinct central axis; outer area of small cellular structure, inclining in the opposite direction or upwards and outwards; separation between these areas formed by an intermediate area of larger, nearly horizontal cellular structure; (horizontal section) a large central area of small, irregular, cellular texture, from which the primary lamellæ radiate to the outer walls; intermediate zone with few vesicular plates between the lamellæ; outer zone having the primary and secondary lamellæ connected by very numerous vesicular plates." It will be seen from the above that most of the essential features in the structure of *Clisiophyllum* are rightly represented in the descriptions and figures given by M'Coy. More especially has he the merit of clearly recognizing the triareal structure of the corallum. The chief defects of his definition lie in his supposition that the ascending

lamellæ of the central area are truly the septa, and in his not having detected the constant presence of a columellarian line in the centre.

At a later period, Mr. Billings (Can. Journ. new ser. vol. iv. p. 128, 1859) defined the genus as similar in structure to *Zaphrentis*, except in the possession of an exterior zone of vesicular tissue and in having the tabulæ "elevated in the centre so as to form a small conical protuberance in the bottom of the cup." A single species, from the Devonian formation of Western Ontario, was referred to the genus under the name of *C. oneidaense*. We have satisfied ourselves, however, from the examination of a large number of specimens, that the structure in *C. oneidaense*, as well as in the related *C. pluriradiale*, Nich., is essentially different from that of *Clisiophyllum* proper; and we propose to found for these two forms a new genus under the name of *Acrophyllum**.

The definition of the genus *Clisiophyllum* given by Prof. De Koninck (Anim. Foss. Nouv. Recherches, prem. partie, p. 39, 1872) is in most respects similar to that given by Milne-Edwards and Haime. The septa are described as extending to the centre of the calice; and the columellar plate is stated to be a prolongation of the principal septum.

Much the same view of the structure of the genus is taken by Dybowski (Mon. der Zoanth. scler. rug. p. 82, 1873), who places *Clisiophyllum* in the immediate neighbourhood of *Lithostrotion*, and defines it as having septa which closely embrace a freely projecting columella, and elevate themselves to form collectively an eminence in the centre of the calice.

When we come, however, to investigate the affinities of *Clisiophyllum*, it is at once evident that it has little real relationship with *Lithostrotion*. Not only is the latter invariably

* A brief diagnosis of this genus may advantageously be appended in this connexion:—

ACROPHYLLUM, Thomson and Nicholson.

Gen. char. Corallum simple, turbinate, or cylindro-conical. Epitheca thin, with numerous encircling striæ and annulations of growth. Central area occupied by strong tabulæ, which are not vesicular, and are very strongly elevated centrally, and at the same time more or less twisted with a spiral bending, so as to give rise to a central funnel-shaped and obliquely contorted eminence. This eminence is formed solely by the elevation of the successive tabulæ; and no vertical plates take part in its formation as is the case in *Clisiophyllum*. The septa are well developed, lamellar, usually prolonged over the upper surfaces of the tabulæ in the form of striæ which extend nearly to the centre. External area traversed by the septa, which are united by comparatively remote angular dissepiments. No columella. A well-marked septal fossette.

Type sp. *Acrophyllum oneidaense*, Bill.

compound, but it possesses no representative of the great central cellular mass, formed by obliquely ascending and vesicular tabulæ, and traversed by vertical lamellæ, which is so characteristic of the former. On the other hand, a relationship of real affinity subsists between *Clisiophyllum* and *Lonsdaleia*, the great central columella of the latter representing the central vesicular mass of the former, and being in many respects formed in nearly the same way, though on a much smaller scale. *Lonsdaleia*, however, is distinguished from *Clisiophyllum* by being always compound, by increasing by calicular gemmation, and by the fact that the wide and loose vesicular tissue of the outer area is not traversed by the septa, which thus are not in connexion with the wall.

The genus *Cyclophyllum*, Duncan and Thomson, though in some respects allied to *Clisiophyllum*, is distinguished from it by the fact that the bottom of the calice exhibits a secondary circular cup, in place of the conical boss of the latter. On section this cup is seen to be the upper extremity of a great central tube, which passes downwards to near the lower extremity of the visceral chamber. The boundaries of the central tube are formed by a distinct accessory wall; and its enclosed space is filled with delicate vesicular tissue, becoming more or less irregular and spongy in the centre. The genus *Aulophyllum*, Edw. & H., is separated from *Clisiophyllum* by characters very much the same as those which serve to distinguish *Cyclophyllum* from the same, especially by the fact that, in common with *Cyclophyllum*, it possesses a secondary cup in the centre of the calice, in place of a conical boss.

The genus *Clisiophyllum*, finally, is more or less intimately related to several groups of forms which we shall proceed to describe under the names of *Dibunophyllum*, *Aspidophyllum*, *Kumatiophyllum*, and *Rhodophyllum*. All these forms may be unhesitatingly regarded as being modifications of a common type; and it need, therefore, excite no surprise to find that the ground-plan of their organization is the same. At the same time the differences which separate these several groups from one another and from *Clisiophyllum* are constant in a large number of individuals in each case, and are easily recognized in typical examples. We cannot, therefore, avoid recognizing the actual existence of these groups as natural assemblages, irrespective of the fact that specimens can be procured which are intermediate in their structural characters between these groups, and thus link them on to one another. As these forms also are separated from one another by characters which can be readily determined in practice, we have judged it better to assign to each group a distinctive name. In so doing, how-

ever, we do not necessarily contend that these groups attain to the conventional rank of *genera*. Believing that the terms "genera" and "subgenera," as applied to inosculating groups like the one we are now considering, possess a purely artificial value, we are not concerned to contend for the employment of the one term rather than the other. We are, however, of opinion that the use of subgenera in palæontological investigations has proved itself by experience rather a hindrance than a help to progress; and we have therefore preferred to leave these groups in the position of "generic types" until some strict and explicit definition of the terms "genus" and "subgenus" may fortunately be agreed upon.

The genus *Clisiophyllum* is stated to range from the Upper Silurian to the Lower Carboniferous. The true affinities of the Silurian forms, however, cannot be regarded as altogether free from doubt; and it is singular, if they have been rightly determined, that no representatives of the genus (as here defined) have hitherto been detected in the richly fossiliferous deposits of the Devonian period.

Genus DIBUNOPHYLLUM, Thomson and Nicholson.

(*δῖς, twice; βουνός, hill; φύλλον, leaf.*)

Gen. char. Corallum simple, turbinate, or cono-cylindrical. Epitheca complete, thin, with numerous encircling striæ and annulations of growth. Calice of variable depth, usually shallow, exhibiting centrally at the bottom a rounded eminence, which is slightly raised above the inner margins of the primary septa, and is always divided by a distinct longitudinal mesial line separating the eminence into two equal halves. The calicine eminence is formed partly by a median elevation of the tabulæ, and partly by a series of somewhat irregular vertical lamellæ, which are united with the inner edges of the primary septa by subconvolute plates, but are altogether independent of these structures, and appear on the surface of the boss as so many ridges radiating from the margins of the central area to the sides of the mesial crest. Septa well developed, generally of two orders; the secondary septa short or wanting, and the primary septa invariably falling short of the central area. Interseptal dissepiments scanty and remote in the intermediate area between the inner ends of the primary septa, but very abundant in the external area, where they form a dense vesicular tissue, appearing in longitudinal sections as minute lenticular cells arranged in oblique rows directed upwards and outwards. Longitudinal sections also

show an intermediate area ("interocular area") of irregularly vesicular tabulæ, and a central area of anastomosing concave tabulæ, which are on the whole directed upwards, and are intersected by several incomplete columellarian lines, or rarely by one such line. Transverse sections show that the central area is divided into two equal portions by a median lamina which extends completely across it, and one extremity of which points to a well-developed septal fossula.

In the general features of their internal structure the forms which we have grouped together under the name of *Dibunophyllum* present a close resemblance to those which properly belong to *Clisiophyllum*; but they are nevertheless separated by characters sufficiently distinct and easily recognizable to warrant their being placed in a section by themselves. The species of *Dibunophyllum* agree with those of *Clisiophyllum* in their triareal structure, as shown in longitudinal sections. They both possess an outer area of numerous minute vesicles arranged in oblique rows pointing upwards and outwards, an intermediate area formed by loosely and irregularly anastomosing tabulæ, and a central area formed by vesicular tabulæ, which, though more or less strongly elevated centrally, are at the same time concave, and are intersected by a series of vertical lamellæ. In both groups, again, we find an essentially similar arrangement and a like development of the septa—those of the first cycle, extending from the wall to near the outer margins of the central area, having the form of well-developed laminae internally, but becoming more delicate as they pass outwards, and more numerous intersected by the angular dissepiments; whilst those of the second cycle are very short, and may be wanting altogether.

With these points of resemblance there are the following differences to be noted in the structure of the forms respectively referable to *Dibunophyllum* and *Clisiophyllum*:—(1) The central area in both genera is formed by the intersection of a system of vesicular tabulæ with a system of vertical lamellæ. In *Dibunophyllum* this area is seen in transverse sections (Pl. XXV. figs. 1, 2, 3 A, 5) to be divided into two equal halves by a complete mesial septum, no such structure existing in *Clisiophyllum* proper; whilst the lines representing the cut edges of the vertical laminae are much more irregular in the former than in the latter, and are devoid of any spiral bending. (2) One extremity of the mesial septum just spoken of as dividing the central area in *Dibunophyllum* is invariably directed towards a well-marked septal fossula (Pl. XXV. fig. 1). (3) Longitudinal sections show that the

central area in *Clisiophyllum* is intersected by a single, continuous columellarian line. The same appearances are occasionally, though rarely, exhibited in *Dibunophyllum*; but more commonly (Pl. XXV. fig. 4 A) there are several of such lines in the latter, and these lines are discontinuous. (4) The floor of the calice in *Clisiophyllum* exhibits an acutely conical boss, the surface of which presents a number of spirally twisted ridges, which are the free edges of the vertical lamellæ of the central area, and are directed in a radiating manner towards a point on the summit of the boss. The floor of the calice in *Dibunophyllum*, on the other hand, exhibits a low rounded boss (Pl. XXIV. fig. 4), which is only slightly elevated above the inner edges of the primary septa, and is invariably divided into two equal moieties by a longitudinal mesial ridge; whilst the ridges representing the free edges of the vertical lamellæ of the central area radiate, without any tendency to become spirally twisted, from the margins of the eminence, till they become attached to the two sides of the mesial ridge. (5) The tabulæ of the central area in *Dibunophyllum*, though on the whole elevated centrally, are typically markedly concave, with their concavities directed upwards (Pl. XXV. fig. 4 A), the reverse of this condition obtaining in *Clisiophyllum*. (6) Lastly, the secondary septa are much less perfectly developed than is usually the case in *Clisiophyllum*, being either unrecognizable, or only traced with difficulty in the dense vesicular tissue of the outer area.

Upon the whole the above-mentioned distinctions appear, in our opinion, of sufficient weight to warrant the establishment of the group which we have termed *Dibunophyllum*. At present we are only acquainted with the genus as occurring in the Lower Carboniferous rocks.

Genus ASPIDOPHYLLUM.

Aspidophyllum, Thomson, Proc. Phil. Soc. Glasgow.

The essential structure of the corallum in this group agrees with that which has been already described as characteristic of *Clisiophyllum* and *Dibunophyllum*; and it will therefore be probably sufficient to point out here the peculiarities which may be regarded as distinctive of *Aspidophyllum* as compared with the preceding groups:—(1) The corallum in *Aspidophyllum*, like that of *Clisiophyllum* and *Dibunophyllum*, is triareal in composition; and the structure of the *external* and *intermediate* areas is essentially identical in the three groups. The chief points which distinguish *Aspidophyllum* are those

connected with the *central area*. As exhibited in longitudinal sections (Pl. XXIII. fig. 1) the central area in these forms is constituted by a succession of extremely close-set tabulæ, somewhat concave, with their convexities directed downwards, and intersected by two or three parallel, nearly continuous columellar lines. (2) As exhibited in transverse sections (Pl. XXIII. figs. 1 A, 2, 3 A, 4) the central area is seen to be formed by the tabulæ just mentioned, together with a series of vertical lamellæ which (as in *Clisiophyllum* and *Dibunophyllum*) are wholly independent of the primary septa, except so far, that they are occasionally connected with them by subconvolute plates. The cut edges of these lamellæ, as seen in section, show that their number is comparatively small, and that they radiate, usually without twisting, from the margins of the central area towards the centre; whilst they are united laterally by a number of closely arranged curved lines, representing the cut edges of the tabulæ, and invariably directed with their concavities outwards. (3) The median member of this comparatively small system of vertical lamellæ is invariably the most strongly developed of all, but it never extends across the central area as a complete mesial septum (as in *Dibunophyllum*). It is invariably directed towards the dorsal or convex side of the corallum, and is continued in all cases for a certain distance into a well-marked septal fossula. (4) As the consequence of the peculiarities in the internal structure of the central area in *Aspidophyllum*, the resulting eminence in the floor of the calice presents certain features which readily distinguish it from the same eminence in *Clisiophyllum* and *Dibunophyllum*. The calicine boss (Pl. XXIII. figs. 2 A, 5) constitutes a prominent helmet-shaped eminence, which is neither conical as in *Clisiophyllum*, nor simply rounded as in *Dibunophyllum*, but is dome-shaped on the ventral or concave side of the corallum, and slopes down on the dorsal or convex side to the inner margin of the primary septa. The free edges of the vertical lamellæ of the central area appear on the surface of the boss as so many keeled ridges, which are not spirally bent as in *Clisiophyllum*, and do not meet on the two sides of a central ridge as in *Dibunophyllum*. The median ridge, however, representing the median lamella, passes over the boss, and descends into the fossula on the dorsal side of the corallum.

So far as our present researches have extended, the corals which belong to this section are confined to the Lower Carboniferous rocks.

EXPLANATION OF THE PLATES.

(Unless otherwise stated, all the figures are of the natural size.)

PLATE XXI.

- Fig. 1. *Clisiophyllum Keyserlingi*, M'Coy (?), transverse section of an extremely large example. Lower Carboniferous, Auchenskeoch, Dalry, Ayrshire.
- Fig. 2. Transverse section of a smaller example of the same species; 2 A, longitudinal section of the same, showing the columellarian line and the convex elevated and vesicular tabulæ of the central area. Lower Carboniferous, Broadstones, Beith, Ayrshire.
- Fig. 3. *Clisiophyllum bipartitum*, M'Coy, transverse section a little below the calice; 3 A, 3 B, 3 C, transverse sections of the same corallum at different heights, showing the different stages of growth. Lower Carboniferous, Broadstones, Ayrshire.
- Fig. 4. Longitudinal section of *C. bipartitum*, M'Coy, showing the triareal structure; 4 A, transverse section of the same, showing the great disproportion between the number of the primary septa and the number of the vertical lamellæ of the central area. Lower Carboniferous, Broadstones, Ayrshire.
- Fig. 5. *Clisiophyllum*, sp., transverse section; 5 A, longitudinal section of the same. Lower Carboniferous.
- Fig. 6. *Clisiophyllum*, sp., transverse section. Lower Carboniferous, Brockley, Lesmahagow.

PLATE XXII.

- Fig. 1. *Clisiophyllum*, sp., showing the external aspect and the conical boss in the floor of the calice; 1 A, transverse section of the same. Lower Carboniferous, Broadstones, Ayrshire.
- Fig. 2. *Clisiophyllum*, sp., transverse section. Lower Carboniferous, Langside, Beith, Ayrshire.
- Fig. 3. *Clisiophyllum coniseptum*, Keys., longitudinal section; 3 A, transverse section of the same. Lower Carboniferous, Langside, Beith, Ayrshire.

PLATE XXIII.

- Fig. 1. *Aspidophyllum Koninckianum*, Thoms., longitudinal section; 1 A, transverse section of the same. Lower Carboniferous, Thirdpart, Beith, Ayrshire.
- Fig. 2. *Aspidophyllum elegans*, Thoms., transverse section; 2 A, calice of the same, showing the helmet-shaped calcine boss. Lower Carboniferous, Thirdpart, Beith, Ayrshire.
- Fig. 3. A young example of the preceding species, showing the helmet-shaped boss; 3 A, transverse section of the same. Lower Carboniferous, Brockley, Lesmahagow, Lanarkshire.
- Fig. 4. *Aspidophyllum*, sp., transverse section. Lower Carboniferous, Brockley, Lesmahagow.
- Fig. 5. *Aspidophyllum*, sp., external aspect, showing the calcine boss in profile; 5 A, transverse section of the same. Lower Carboniferous, Brockley, Lesmahagow.

PLATE XXIV.

- Fig. 1. *Aspidophyllum Huxleyanum*, Thoms., transverse section, enlarged; 1 A, transverse section of the same, natural size. Lower Carboniferous, Thirdpart, Beith, Ayrshire.
- Fig. 2. *Aspidophyllum*, sp., transverse section. Lower Carboniferous, Gateside, Beith, Ayrshire.
- Fig. 3. *Dibunophyllum Muirheadi*, Nich. & Thoms., transverse section; 3 A, longitudinal section of the same. Lower Carboniferous, Gateside, Beith, Ayrshire.
- Fig. 4. *Dibunophyllum*, sp., view of the interior of the calice, showing the arrangement of the ridges formed by the free edges of the vertical lamellæ of the central area; 4 A, transverse section of the same. Lower Carboniferous, Langside, Beith, Ayrshire.

PLATE XXV.

- Fig. 1. *Dibunophyllum*, sp., transverse section, showing the mesial lamina which divides the central area; the septa become vesicular and broken up towards the circumference by the great development of the dissepiments. Lower Carboniferous, Langside, Beith, Ayrshire.
- Fig. 2. Transverse section of a young form of *Dibunophyllum*; 2 A, external aspect of the same, showing the interior of the calice.
- Fig. 3. *Dibunophyllum M Chesneyi*, Nich. & Thoms., showing the interior of the calice; 3 A, transverse section of the same; 3 B, longitudinal section of the same, showing the unusual fact that there is but a single columellarian line, as in *Clisiophyllum*. Lower Carboniferous, Brockley, Lesmahagow.
- Fig. 4. *Dibunophyllum Muirheadi*, Nich. & Thoms., transverse section; 4 A, longitudinal section of the same, showing the normal structure of the genus. Lower Carboniferous, Gateside, Beith, Ayrshire.
- Fig. 5. *Dibunophyllum Muirheadi*, Nich. & Thoms. (?), transverse section. Lower Carboniferous.
- Fig. 6. *Dibunophyllum*, sp., interior view of the calice; 6 A, transverse section of the same. Lower Carboniferous.
- Fig. 7. *Dibunophyllum*, sp., transverse section. Lower Carboniferous.

[To be continued.]

LIV.—On the Identity in Type of the Annelids and Vertebrates.
A preliminary Communication*. By C. SEMPER.

THE old view of Geoffroy St.-Hilaire and Ampère concerning the agreement in affinities of the Articulates and Vertebrates was, as is well known, completely supplanted by the type theory of Cuvier and Von Baer, which supposed a great difference in the structure of the two groups. And not without good reason; for if the inversion of an Articulate so that its ventrum was

* Translated from the 'Physikalisch-medicinische Verhandlungen zu Würzburg,' by P. Herbert Carpenter, B.A.